HARVEST SYSTEMS

Designing a Harvest

BMP Plan timber harvest in consideration of your management objectives and the following:

1. Soils and erosion hazard identification
2. Rainfall
3. Topography
4. Silvicultural objectives
5. Critical components (aspect, water courses, landform, etc.)
6. Habitat types
7. Potential effects on water quality and beneficial water uses
8. Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production
9. Wildlife habitat
10. Biodiversity and native species
11. Long-term site productivity
12. Organic matter removal and retention tradeoffs

Which Harvesting System?

There are Five Different Timber Harvesting Systems:

1. Cut-to-length harvesting
2. Whole tree harvesting
3. Hand logging
4. Cable logging
5. Helicopter logging

Harvest site terrain influences the choice of a logging system. On gentle terrain, tree processors and forwarders, tractors and skidders, and even horses can be a logical choice. On steep terrain, cable harvesting equipment is used. Each logging system is described in the following pages.

BMP Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.

BMP Use the economically feasible yarding system that will minimize road densities.

A timber harvest plan must consider the long-term effects of harvesting on all forest resources. Before any timber harvest, ask the following questions:

QUESTION: When combined with other harvests and road construction in the watershed, will there be a detrimental effect on water yield and increase in sediment?

Are there soils present with a high potential for compaction and/or erosion?

Do I understand the topography – slopes, drainages, streams and other physical features?

Are there riparian and wetland plants indicating areas that require special attention? (See page 9)

QUESTION: How will the harvest affect wildlife habitat? For example, will the alteration of elk habitat displace elk use of the area?

What accommodations have been made to protect wildlife habitat?

QUESTION: What kind of forest will be grown after the harvest, and how quickly will the site be reforested?

What kind of slash treatment and site preparation will be necessary? (See pages 54–55)

CUT-TO-LENGTH HARVESTING

The processor severs, delimbs and cuts trees into logs that are sorted and stacked in the forest. The forwarder picks up the logs in the forest and transports them to trucks.

Advantages
- Leaves slash (tree branches and tops) in the forest.
- Minimizes the need for access roads and log landings.

Topography Considerations
- Limited to terrain with less than 40 percent slopes.

Soil Considerations
- Preferred system where soils are susceptible to compaction.
- Minimizes soil disturbance by confining machines to designated trails.
- Slash stays in the forest and acts as fertilizer.

Forest Stand Considerations
- Efficient method for commercial thinning.
- Moves short logs out of the forest rather than long logs.
- Useful for reducing wildfire hazard.

Equipment Used
- Tree processor
- Forwarder

Slash Disposal
- Slash is handled efficiently by the carpet of slash left by the processor.
- Usually complies with slash hazard requirements without additional treatment.

Reforestation Considerations
- Preferred in stands where additional tree seedlings are not wanted.

Economic Considerations
- Fewer roads may reduce overall harvest costs.
- This machinery is expensive and availability may be limited.
- Collection of biomass (tops, limbs) for removal is less economical

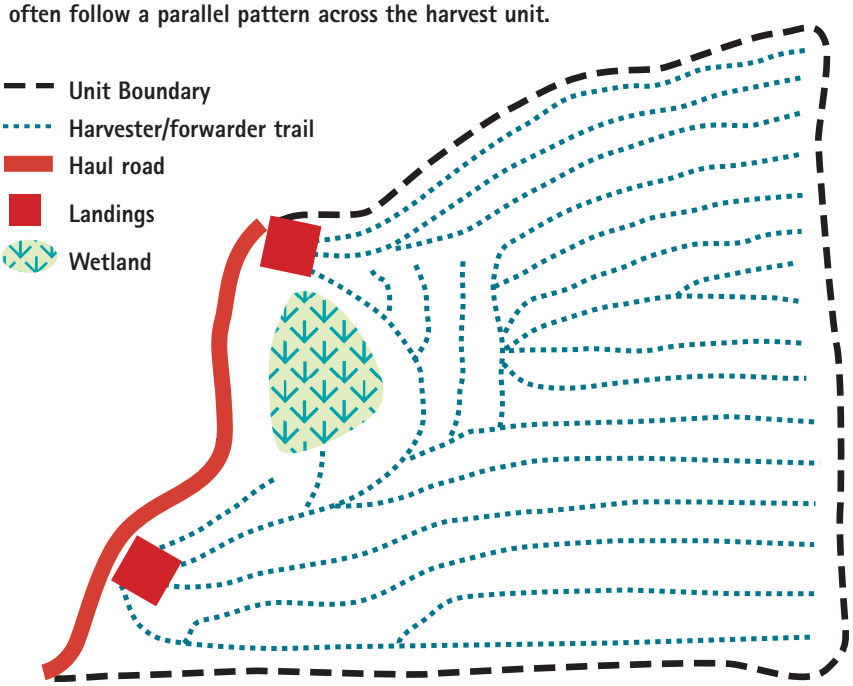
Single grip processors reach out 30–40 feet, cut a tree, strip the limbs, cut the stem into computer programmed lengths, and lay the logs on the ground, all in less than one minute. These machines travel on the carpet of tree tops and limbs they leave.

Forwarders follow behind the harvester, using the same slash carpet, picking up logs and delivering them to the landing. They can travel long distances, reducing the need for haul roads.

Logs are offloaded from the forwarder directly to log trucks.

Typical Harvest Layout

Designated harvester/forwarder trails are approximately 60 feet apart and often follow a parallel pattern across the harvest unit.



WHOLE TREE HARVESTING

A feller-buncher cuts and piles small bundles of trees. A tractor drags the tree bundles to the landing with limbs and tops attached to the stem.

Advantages

- Biomass (including slash, tree tops, limbs or rotted portions of logs) is brought to the landing or roadside where it can be sorted and process for markets, returned to the forest, or piled and burned.

Topography Considerations

- Can be used on slopes up to 50 percent.
- Haul roads are usually at the bottom of the logging area.

Soil Considerations

- Potentially more soil disturbance than cut-to-length harvesting.
- A greater portion of the area is covered by machines as they cut, stack, gather and drag whole trees to the landing or roadside.
- Skid trails can become trenched and compacted from repeated use.
- Potential for less nutrients retained on forest site if slash is not returned/distributed.

Forest Stand Considerations

- Efficient method for stand conversion without clearcut

Equipment Used

- Feller buncher
- Crawler tractor or skidder with grapple
- Stroke-boom delimber
- Log loader

Slash Disposal

- Slash piles are conveniently burned at a later time.
- Sometimes slash is returned to the forest and distributed (see page 55).

Reforestation Considerations

- Dragging tree bundles leaves a seedbed for natural seeding.

Economic Considerations

- Operating on steeper ground raises the harvest cost.
- Longer skid distances increase costs.
- Bunching trees reduces costs for handling biomass and small diameter trees.

A feller buncher severs trees and lays them in bunches with limbs and tops attached. Bunches are oriented with tree trunks facing downhill.

A crawler tractor or skidder with a grapple picks up bunched trees and drags them to a landing or roadside. Some grapples can swing 180 degrees, making it easier to operate in tight spaces.

The stroke-boom delimber operates at the landing or roadside, removing tree limbs and top, cutting the stem into logs and stacking them.

In addition to loading log trucks, the loader is used to pile tops, branches and log chunks for processing or burning.

HAND HARVESTING

Advantages
- Adaptable to smaller harvest locations.
- Generally less costly equipment.

Topography Considerations
- Can be used on slopes up to 50 percent.
- Haul roads are usually at the bottom of the logging unit.

Soil Considerations
- Designated skid trails confine machines to predesigned locations and reduce soil disturbance.
- Multiple trips on the same skid trail can result in a trench.
- Soil disturbance can be minimized by widely spaced skid trails. This requires hand pulling winch line to reach logs that are further from the skidder.
- Lop and scattered slash will retain and return nutrients dispersed throughout forest.

Forest Stand Considerations
- Gives maximum flexibility to a variety of stand management goals.

Equipment Used
- Chainsaw
- Log skidder
- Log loader

Slash Disposal
- Allows for lop and scatter of slash in the forest.
- Alternatives to lop and scatter are more complicated and could involve pile and burn.

Reforestation Considerations
- Results in ground scarification, creating locations for natural regeneration or hand planting.

Economic Considerations
- Often more labor intensive.
- Generally, more roads are necessary.

BMP Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Use existing skid trails where practical, located appropriately, and consistent with other management objectives.

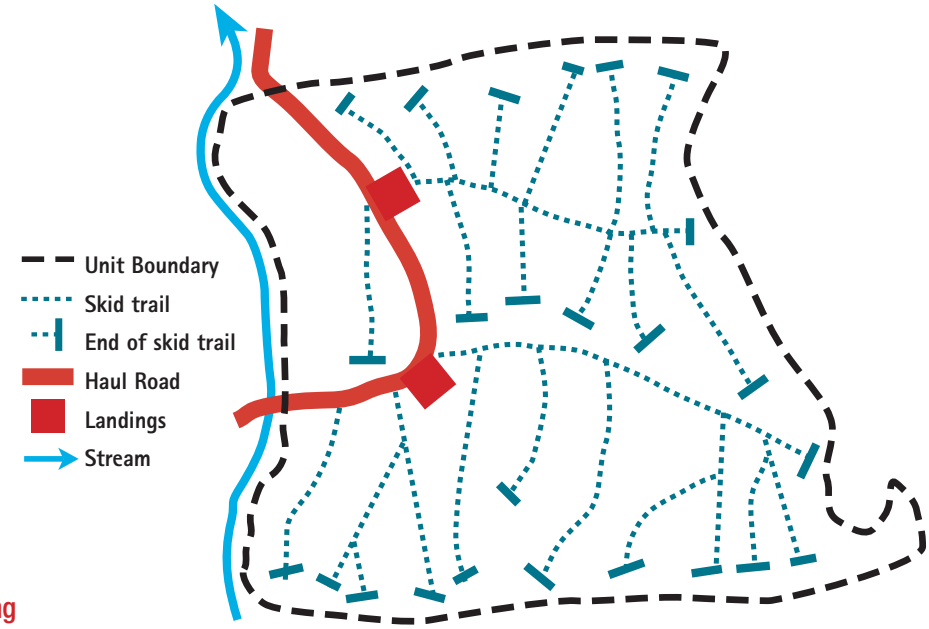
Tree felling, limbing and bucking are done with chainsaws.

BMP Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.

Logs are dragged by a skidder from the forest to a log landing. Rubber tired skidders or crawler tractors remain on the skid trail and winch line and chokers pull the logs to the machine. Limbing and bucking are done with chainsaws.

Once at the landing, a log loader moves logs onto trucks for delivery to the mill.

Typical Harvest Layout



Skid trails should be planned and marked in advance. They often follow a parallel branching pattern as shown. By winching logs from greater distance, skid trails can be farther apart, reducing the number of designated skid trails and minimizing the soil impact by equipment.

SLASH TREATMENT/ SITE PREPARATION

BMP Rapid reforestation of harvested areas is encouraged to re-establish protective vegetation.

Why treat slash and prepare the site?

- To reduce the wildfire hazard from logging debris.
- To prepare the harvest area for a new forest.
- To leave enough organic matter for the next forest.

Problems of slash treatment and site preparation

- Soil can be exposed to erosion, especially on slopes greater than 35%.
- Soil can be compacted and/or rutted (see page 45).
- There can be loss of organic matter needed for the next forest.

Too much slash cleanup. When the forest is swept clean, soil erosion, compaction, soil displacement (moved and rutted soil), and nutrient loss interfere with a successful next forest.

What's Required

Montana's Slash Hazard Reduction Law requires removal of some logging slash to prevent wildfire. However, the foliage and branches left after a harvest are a source of organic matter and nutrients needed for the next forest. Slash also protects soil from erosion. A balance is required between the need to reduce fire hazard and the need for organic matter and soil protection.

Starting a new forest requires patches of exposed mineral soil on the forest floor. Seed from nearby trees germinates best in bare mineral soil. Mechanical slash treatment and site preparation must create some bare soil while minimizing erosion. At the same time, heavy equipment can compact soil, especially wet soil (see page 45).

Slash Treatment/Site Preparation On Gentle Terrain

How to achieve the balance between the need for mineral soil and organic matter while minimizing erosion and reducing fire hazard.

Method 1: Machine Pile and Burn Slash

After logs are removed, excavators or tractors equipped with a brush blade are used to pile slash for burning. Machine piling reduces the fire hazard and creates a seedbed for the new forest. Some landowners like the look of a "cleaned-up" forest. But this method is expensive, not recommended on compactible soils, and may not provide the next forest with the organic matter needed for best growth.

BMP Minimize or eliminate elongated exposure of soils up and down the slope during mechanical scarification.

BMP Carry out brush piling and scarification when soils are frozen or dry enough to minimize compaction and displacement.

What to Avoid When Machine Piling

Work around small trees, low brush and large logs.

Stay clear of wet areas where compaction, soil rutting and erosion can result.

BMP When treating or removing slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.

BMP Scarify the soil only to the extent necessary to meet the resource management objectives. Some slash and small brush should be left to slow surface runoff, return soil nutrients and provide shade for seedlings.

Method 2: Whole Tree Harvesting

Whole tree harvesting brings the entire tree, branches and top, to the landing. There, the branches and tops are removed, sorted and processed for markets, or piled and burned. Most slash is brought to a landing or central location and efficiently disposed of. Leaving some slash in the woods promotes nutrient recycling and provides habitat for a variety of species. But important soil organic matter is removed, and the disturbed forest floor may be susceptible to erosion and nutrient loss.

Method 3: Whole Tree Harvest but Return Slash

The same machines that bring whole trees to the landing can carry a portion of the slash back and scatter it on the forest floor. This method makes slash fertilizer available to the next forest and keeps soils protected from erosion, especially on skid trails. The fire danger is minimal because the slash is crushed and close to the ground. Some landowners object to the appearance.

Method 4: Lop and Scatter

Tree branches and top are left at the stump. To meet hazard reduction standards, this material must be cut or lopped, so it lays close to the ground for rapid decay. This method protects and nourishes forest soils, but some landowners object to the appearance, while others claim it inhibits livestock and wildlife movement. However, while this is an inexpensive slash treatment for light harvests, it can leave a fire hazard in heavy harvest areas. Lop and scatter, combined with machine trampling, may be a remedy for heavy slash areas.

Slash Treatment/Site Preparation On Steep Terrain

BMP Carry out scarification on steep slopes in a manner that minimizes erosion. Broadcast burning and/or herbicide application is the preferred means for site preparation, especially on slopes greater than 40 percent.

BMP Limit water-quality impacts of prescribed fire by constructing waterbars in firelines, not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

Method 1: Broadcast Burning

On steep slopes, broadcast burning can be an effective site preparation technique, eliminating the problem of soil disturbance and controlling heavy fuels. By carefully monitoring moisture conditions, a fire can be set that consumes only part of the slash, leaving large material in place. Afterwards, the site is either planted or allowed to regenerate naturally. Whole tree harvesting (see page 48) and air quality requirements are making broadcast burning more rare.